Graham, Benita

From: DeFriece, John R. (DNREC) <John.DeFriece@state.de.us>
Sent: Tuesday, October 04, 2016 9:24 AM
To: Smith, Mark
Subject: FW: For DCR MTg. Tomorrow A.M. -- Fish Return System Evaluations
Attachments: removed.txt

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From: Holmes, Virgil (DNREC)
Sent: Monday, March 21, 2016 1:04 PM
To: DeFriece, John R. (DNREC); Hale, Ed (DNREC)
Cc: Ashby, Bryan A. (DNREC); Roushey, Jennifer S. (DNREC); Smailer, Steven M. (DNREC); Arndt, Tricia K. (DNREC); Clark, John (DNREC)
Subject: RE: For DCR MTg. Tomorrow A.M. -- Fish Return System Evaluations

John,

I have in my notes “12 inch to 16 inch”, keeping in mind that a 12” pipe has an ID just under 12” and a 16” pipe has an ID just under 15”.

(FYI. For those not familiar with pipe sizing; up to 12” the pipe size correlates to ID and beginning with 14” the pipe size is the OD.) Virgil

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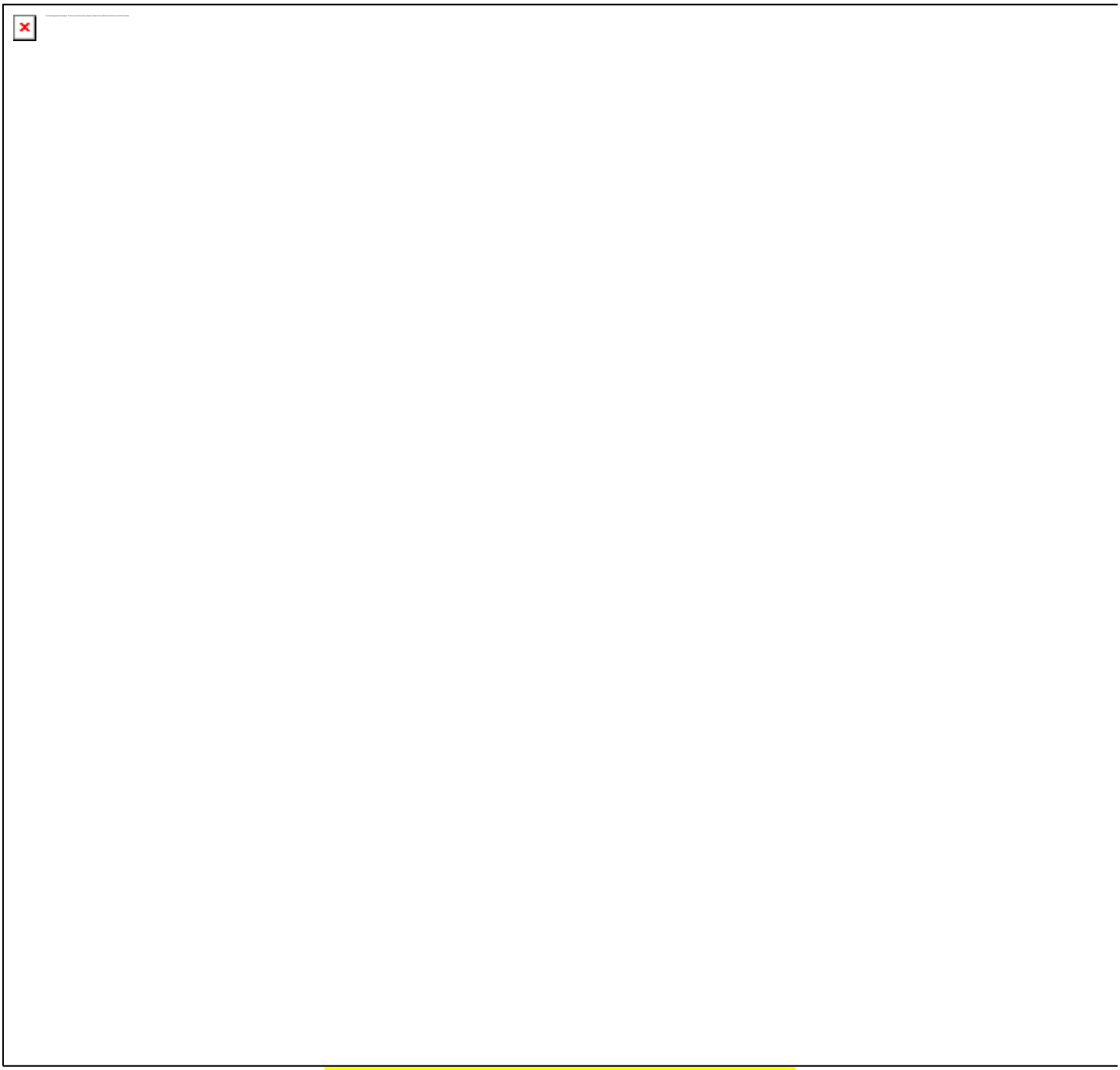
From: DeFriece, John R. (DNREC)
Sent: Monday, March 21, 2016 12:37 PM
To: Hale, Ed (DNREC)
Cc: Holmes, Virgil (DNREC) ; Ashby, Bryan A. (DNREC) ; Roushey, Jennifer S. (DNREC) ; Smailer, Steven M. (DNREC) ; Arndt, Tricia K. (DNREC) ; Clark, John (DNREC)
Subject: RE: For DCR MTg. Tomorrow A.M. -- Fish Return System Evaluations

Ed (and all),

Thanks!*

DCR should submit something in writing about the fish return, before they get too far along in their design phase. In addition to your questions, some of the implications of their proposal have me wondering, “Did I hear that correctly?” Please see yellow highlights below.

Re. 5’ fall at the end of the pipe, NPDES dischargers usu. like to have the discharge pipe end below the waterline. Experience has been that anytime somebody unfamiliar (with that pipe & its NPDES permit) sees it, they call the hotline to ask about “an illegal discharge”. Guess it’s not a concern for DCR since the proposed discharge point is well within their property. This is from the 2011 Draft BTA Determination, oft-referenced in hearing comments.



They proposed a fish return with a 12” pump that will go into a 14” fish transport pipe. **Did anybody hear that differently?** The earlier referenced Salem (Nuclear Generating Station) study recommends ≥18”, to reduce fish abrasion.

Parameter	Value	Units	Notes
Conversion Factors	0.13368	ft^3/gal	
	264.2	gallons/m^3	
pipe cross-section	1.06901	ft^2	14” pipe?
Flow Rate	9,000,000	gallons/day	= Permit Limit for Outfall 501

	1,203,120	ft^3/day	
	835.5	ft^3/min	
	6,250	gpm	
	34,068.7	m^3/day	
	23.7	m^3/min	
Flow Velocity at pipe exit	13.0	ft/sec	For a State Construction permit, the "10 States Standards" recommended range is 2-10 fps, to prevent damage to the pipe itself.

At 13 fps (for perspective, that's 8.9 mph), it'd take

Thought DCR said "Hydrostatil" pump, but looks like it's "Hidrostal". Found some info/specs for the brand of fish pump they mentioned:

> "Fish Friendly Pumps" - http://www.hidrostal.co.uk/versatile-pumps.php?id=6
>
> "Hidrostal Bedford Pumps" - http://www.fishfriendlypumps.co.uk/
>
> Study - http://www.fishfriendlypumping.co.uk/cody/upload/pdfs/w6i5a1441275165.pdf. I have not found anything resembling the 90° turn pump figure they showed at the meeting. Also could not find specs. for a 12" Hidrostal pump (pumps in figures look a LOT bigger). Doesn't help that the technical appendices are in Dutch.

Lastly, found another reference with some discussion of fish return design, "Technical Development Document for the Final Section 316(b) Existing Facilities Rule"**

DCR

John

*Had to look up "CFD".
**EPA-821-R-14-002, May 2014, http://www.epa.gov/sites/production/files/2015-04/documents/cooling-water_phase-4_tdd_2014.pdf,

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From: Hale, Ed (DNREC)
Sent: Friday, March 18, 2016 4:12 PM
To: DeFriece, John R. (DNREC)
Cc: Holmes, Virgil (DNREC); Ashby, Bryan A. (DNREC); Roushey, Jennifer S. (DNREC); Smailer, Steven M. (DNREC); Arndt, Tricia K. (DNREC); Clark, John (DNREC)
Subject: RE: For DCR MTg. Tomorrow A.M. -- Fish Return System Evaluations

Thank you very much John. It initially appears to me that the estimated survival is higher in the two freefall alternatives relative to the existing submerged fish return outflow pipe from the laboratory test results (Highlighted sections below). However, the study did not consider reducing the angle of approach of the submerged point of discharge from the existing 34° at the PSEG end of pipe. I question if decreasing that angle would decrease shear associated with the intermixing of the two water currents and subsequently increase survival. Further, while the study did do an adequate job in characterizing the physical stressors (pressure; impact and abrasion; turbulence and shear; and velocity) associated with transport along the three alternative fish return systems described, particularly at the end of pipe, the study did not address other relevant physiological stress, such as temperature induced effects of animals coming into contact with atmospheric temperatures, then undergoing submersion in ambient surface water conditions, after undergoing a period of transport. I am not convinced the DCR proposed end of pipe discharge (5-6 feet at normal low tide) is maximizing the survival of fish, as I have not found any evidence to suggest fish do not suffer from thermal stress when being exposed to atmospheric temperatures. Beyond that, I would question how deep of a pool would be created by the freefall discharge as, this may act as a net attractant for predators thus increasing the mortality of entrained fish at multiple life history stages. I would suggest that the proposed option seriously consider submerging the end of pipe discharge at the slightest angle possible to decrease shear, as well as complying with the other NMFS control measures to maximize fish survival.
Respectfully,
Ed

4.4. End-of-Pipe Testing

> The CFD analyses of the existing fish return system indicated that a hydraulic jump occurs as flow enters the Delaware River in the 40-in. diameter discharge pipe. CFD analyses of alternative system designs indicated that bounded flows (*i.e.,* flows within the 40-in. return pipe) resulted in higher stressor levels than un-bounded flows (*i.e.,* freefall).

7.1.3. End-of-pipe Laboratory Tests

> ….4. When adjusted for control mortality, existing and alternative test conditions produced survival rates of 99.5% for the existing EOP, 101.4% for the 1.3-ft freefall alternative, and 100.4% for the 6-ft freefall alternative.

Edward A. Hale, Ph.D.
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Phone: 302-735-2969

From: DeFriece, John R. (DNREC)
Sent: Friday, March 18, 2016 10:04 AM
To: Hale, Ed (DNREC)
Cc: Holmes, Virgil (DNREC); Ashby, Bryan A. (DNREC); Roushey, Jennifer S. (DNREC); Smailer, Steven M. (DNREC); Arndt, Tricia K. (DNREC)
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Ed,

Promised to send the attachment. It's the same as below, but I added 6 bookmarks.

Says some surprising things about what fish can survive (e.g., 30 fps velocity*), but then you have to dig for details about conditions needed for them to survive well.

John

P.S. Per the attachment, injuries are more from sudden changes in velocity.

Flashback to 1974 sophomore physics class, a quote from Dr. John W. Preiss at U. De.

– "The fall didn't kill King Kong. It was the sudden change of velocity at the end."

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From: DeFriece, John R. (DNREC)
Sent: Thursday, March 17, 2016 4:10 PM
To: Holmes, Virgil (DNREC); Ashby, Bryan A. (DNREC); Roushey, Jennifer S. (DNREC)
Cc: Clark, John (DNREC); Hale, Ed (DNREC)
Subject: For DCR MTg. Tomorrow A.M. -- Fish Return System Evaluations

Attachment is from https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-737.pdf

Title Page

Fish Return System Evaluations

Salem Generating Station, NJPDES Permit No. NJ0005622
Custom Requirement G.2.b.ii Fish Return System Evaluations
Section 316(b) Special Condition

Final Report Prepared for: PSEG Services Corporation
Estuary Enhancement Program

Prepared by: ALDEN Research Laboratory, Inc.
Environmental Services
30 Shrewsbury Street, Holden, MA 01520
December 2002

Table 4. Criteria for the design of fish conveyance structures (modified from ASCE 1982). – (pg. 17, .pdf file pg. 27 of 154)

Criteria	Stressor(s)
All surfaces of conveyance structures must be smooth to prevent abrasion to fish. Suitable materials include fiberglass, polyethylene or coated steel to prevent injury to fish.	
The system size must be based on the number and size of fish. Use a minimum water depth of 6 in. (15.2 cm), minimum width 18 in. (45.7 cm). Appropriate free board must be provided based on the jumping capability of the strongest fish to be transported.	Abrasion and impact.
Transport velocities must be larger than the sustained cruising speed of the fish, often 2 to 4 fps (0.61 to 1.22 m/sec).	Limits physiological
Materials used for the structures must minimize biofouling.	Abrasion and reduction in
Long radius (r/d > 2.5) bends must be provided so that fish do not abrade on the sides of the bend.	Abrasion
Pipe joints must be constructed carefully so that all edges match and there are no jagged protuberances.	Abrasion and impact
Valves, meters, etc. must provide clear passage for the fish and create as little obstruction as possible.	Impact and reduction in
All transitions must be gradual to prevent flow separation and rapid changes in velocity.	Shear and turbulence
Smooth transitions must be provided where flow from several pipes or channels combine.	Abrasion and impact
In Northern latitudes, above ground sluiceways or pipes must be protected from freezing. Buried pipes must be located below the frost depth.	Impact and reduction in
Velocity control weirs must have drainage orifices to reduce entrapment of fish and debris when the water supply is shut down for cleaning screens. The sluiceway must completely drain following shut down.	

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